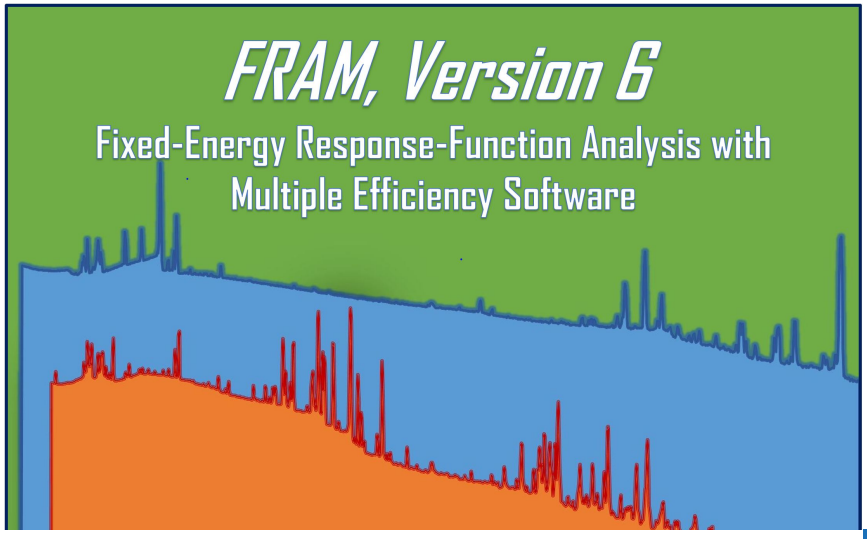
LA-UR-21-31098
Approved for public release; distribution is unlimited.

Title: FIXED-ENERGY RESPONSE-FUNCTION ANALYSIS WITH MULTI-EFFICIENCY (FRAM) SOFTWARE, VERSION 6

Author(s): Badura, Kaelyn Skye

Intended for: Web

Issued: 2021-11-05



Los Alamos NATIONAL LABORATORY

Tech Snapshot

Nuclear

Published: Nov 4, 2021

FIXED-ENERGY RESPONSE-FUNCTION ANALYSIS WITH MULTI-EFFICIENCY (FRAM) SOFTWARE, VERSION 6

A Next Generation Tools for Spectrometry-based Isotopic Analysis

SUMMARY

Researchers at Los Alamos National Laboratory have developed Fixed-Energy Response- Function Analysis with Multiple Efficiency (FRAM), a powerful software tool for gamma-ray spectrometry isotopic analysis. This tool leverages Los Alamos expertise in nuclear safeguards, radiation detection systems, and related analysis techniques. A household name in the non-destructive assay community for over two decades, FRAM determines a special nuclear material source's isotopic composition by analyzing gamma-ray spectra. Los Alamos researchers have released the latest version of FRAM that incorporates several updates to the 2013 major release of FRAM, Version 5.

MARKET APPLICATION

FRAM, Version 6 is most applicable in the nuclear safeguards and the radiation detection, monitoring, and safety markets. Primary end users are anticipated to be non-destructive assays practitioners across the government, regulatory, and commercial sectors that are interested in the identification, analysis, and control of special nuclear materials. Isotopic analysis of special nuclear materials is applicable to calorimetry, neutron coincidence counting, bulk measurement techniques, process control, treaty verification, and regulatory confirmation measurements.

BENEFITS

FRAM can be used in conjunction with commercial-off-the-shelf detectors to perform fast and inexpensive gamma-ray isotopic analysis. FRAM, Version 6 incorporates analysis of new spectra and rolls-out several new features to improve usability and compatibility.

- Faster results, as compared to mass spectrometry
- Allows user customization of parameters and analysis
- Accomodates spectra from medium resolution detectors
- Supports background subtraction and spectrum manipulation
- Offers new and improved file input and format options

CONTACT

Kaelyn Badura
kbadura@lanl.gov
505-665-8032

NNSA National Nuclear Security Administration

WHY WE ARE BUILDING FIXED-ENERGY RESPONSE-FUNCTION ANALYSIS WITH MULTI-EFFICIENCY (FRAM) SOFTWARE, VERSION 6

High resolution gamma-ray spectrometry is expensive, whereas usage of medium spectrum resolution detectors (e.g., LaBr3 and CZT detectors) is less cost prohibitive. LaBr3 and CZT detectors operate at room temperature, are more compact and reliable, and are easy to use and maintain. This difference in implementation and operation costs created a need for isotopic analysis tools to accommodate input from these medium spectrum resolution detectors. FRAM was originally developed to measure the isotopic composition of plutonium at the Los Alamos plutonium facility in the 1980s. The capability to analyze uranium was added in 1997, and FRAM has been subsequently upgraded several times improve analytical results and to add new capabilities such as accommodation of LaBr3 and CZT inputs.

WHAT'S BEHIND OUR TECHNOLOGY

FRAM, Version 6 is an enhanced technology that analyzes the gamma ray spectrum from plutonium-bearing items and determines the isotopic distribution of the plutonium as well as the concentration of other isotopes. Furthermore, the software can also be used to determine the isotopic distribution of uranium isotopes in items containing only uranium. FRAM, Version 6 capitalizes on several decades of development and incorporates significant laboratory expertise in handling data interference, isotope ratios and distribution, and other technical special nuclear material considerations encountered in fulfilling its research, development, and mission priorities.

OUR COMPETITIVE ADVANTAGES

FRAM, Version 6 builds upon FRAM, Version 5. Key upgrades in Version 6 include the capability to analyze LaBr3 and CZT, the capability to subtract background peaks from spectra, several enhancements to the display options of spectra, as well as considerable upgrades to the usability of the FRAM software.

OUR TECHNOLOGY STATUS

Los Alamos researchers have released the latest version of Fixed-Energy Response-Function Analysis with Multi-Efficiency (FRAM) Software - FRAM, Version 6. FRAM has a long history of supporting the safeguards and emergency response communities, and Version 6 incorporates usability and compatibility enhancements as well as a new capability to support analysis of inputs from medium resolution LaBr3 and CZT detectors. FRAM, Version 6 is available for non-exclusive licensing.

PUBLICATIONS AND IP

C19129 - FRAM, Version 6, © 2020.

LA-UR-20-21287 - FRAM, Version 6 User Manual